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⑪ Publication number: 0 545 127 A1

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EUROPEAN PATENT APPLICATION

⑬ Application number: 92119523.6

⑬ Int. Cl. 5: A47L 15/42

⑭ Date of filing: 14.11.92

⑬ Priority: 05.12.91 IT PN910080

⑬ Applicant: Zanussi Elettrodomestici S.p.A.
Via Giardini Cattaneo, 3, C.P. 147
I-33170 Pordenone (IT)

⑭ Date of publication of application:
09.06.93 Bulletin 93/23

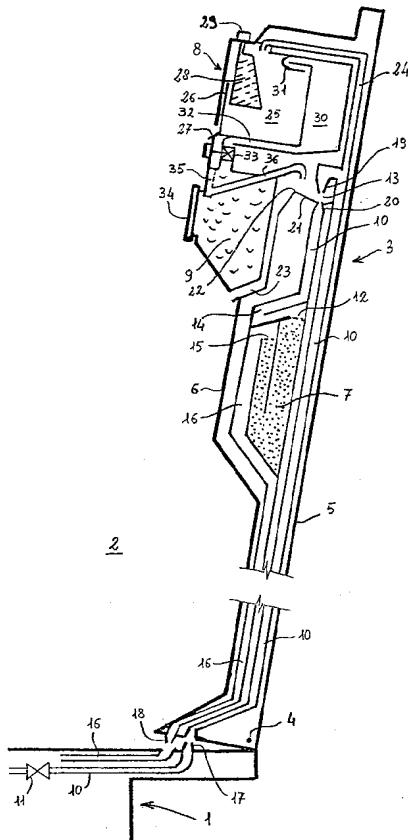
⑬ Inventor: Milocco, Claudio
Via Piero Gobetti 4
I-33170 Pordenone (IT)

⑬ Designated Contracting States:
DE ES FR GB IT

⑬ Representative: Busca, Luciano et al
PROPRIA S.r.l., Via Mazzini 13
I-33170 Pordenone (IT)

⑮ Dishwasher with water supply circuit.

⑮ Dishwasher with a water supply circuit comprising a water softener (7) and a metering reservoir (8) for water suitable to regenerate the water softener through a salt container (9). A portion of the water supply circuit including the reservoir (8), the salt container (9) and the water softener (7) is housed inside the access door (3) of the machine and is connected with the remaining part (10, 11, 16) of the supply circuit through break-away coupling means (17, 18) arranged to break away when the door is opened.



EP 0 545 127 A1

The present invention relates to an automatic dishwashing machine provided with a water supply circuit including a water softener associated with an arrangement suitable to periodically regenerate the water softener.

A simple and effective water supply circuit of this type is for instance described in EP-B-0 219 704, wherein the regeneration arrangement comprises a reservoir for metering a volume of water which is used to regenerate, through a multi-dose salt container, the ion-exchange resins contained in the water softener. The water supply circuit also comprises a solenoid valve to control the amount of water to be fed into the wash tub of the machine, as well as at least a further solenoid valve suitable to control the phases of regeneration of the water softener.

Every solenoid valve is controlled by the programmer of the dishwasher, to which it is connected through special wiring which undesirably complicates the machine and involves safety problems with regard to electrical insulation.

As is known, substantially the entire water supply circuit is usually housed in the hollow space between the wash tub and the non-movable part of the casing of the machine, which is provided with a front access door. Thus, the water supply circuit is arranged in an area which is hardly accessible for mounting and adjusting the various components, and for possible maintenance or servicing purposes, as well. The salt container, in particular, is commonly arranged in the bottom part of the machine and is only accessible, for periodical refill operations, after having drawn the lower crockery support rack out of the wash tub.

A dishwasher is also known, for instance from DE-A-1 800 092, which is provided with a single-dose salt container directly connected with the water supply circuit, upstream of the water softener, and arranged within the access door of the machine. When tap water flows through the supply circuit, part of it fills the salt container, thereby forming brine which flows back by gravity to enter the water softener upon termination of the water supply phase. In order for the dishwasher to operate correctly, however, the salt container undesirably must be filled by the user with a proper amount of salt before starting each operating cycle. In addition, since no means is provided for automatically metering the amount of regeneration water, the corresponding amount of brine and its salt concentration can easily vary according to pressure changes in the water mains, thereby undesirably affecting the whole operation of the machine. Furthermore, the salt container housed in the access door is connected to the water supply circuit through a hydraulic rotary joint, or the like, which is provided in correspondence of the hinge of the

door and undesirably complicates the structure of the dishwasher.

DE-U-8 511 185 describes an automatic dishwasher in which both the water softener and the salt container are housed within the access door of the machine and can mutually communicate through a controlled valve which undesirably requires proper wiring in correspondence of the door, which wiring brings about the electrical insulation problems mentioned above. Moreover, the water softener is connected with the remaining part of the water supply circuit of the dishwasher through flexible pipes which are subject to ruptures after a number of openings and closings of the door. In addition, also this prior art dishwasher suffers from the drawback that the amount of brine which regenerates the water softener, being time-controlled through actuation of the controlled valve, can undesirably vary according to pressure changes in the water mains.

It is the main scope of the present invention to provide a dishwasher with a water supply circuit of the type including a metering reservoir for the regeneration water, which not only is simple and readily accessible, but also very compact, effective and reliable in operation.

Another scope of this invention is to provide a dishwasher of the above-mentioned type wherein the wirings associated with the water supply circuit are substantially reduced and thereby safe with regard to electrical insulation.

According to the invention, these scopes are attained in a dishwasher with water supply circuit embodying the features recited in the appended claims.

The characteristics and advantages of the invention will become more apparent from the following description, given only by way of non-limiting example, with reference to the accompanying drawing. In the drawing, the sole figure diagrammatically and partially shows a preferred embodiment of the dishwasher according to the invention, with the access door in a partially opened position.

In the figure, in particular, only the main components are shown which are necessary for comprehension of the invention.

In a substantially traditional manner, the dishwasher comprises a casing 1 (only the bottom part of which is shown, for the sake of simplicity) housing a wash tub 2 which is accessible through a front door 3 hinged at the bottom on the machine, at 4. The door 3 is of the double-wall kind, with an outer wall 5 and an inner wall 6, the latter forming a portion of the wash tub 2 when the door is closed, in a substantially vertical position.

The dishwasher is equipped with a water supply circuit of the type including a water softener 7 and a metering reservoir 8 for water suitable to

cyclically regenerate the water softener 7 through a multi-dose salt container 9. According to an aspect of the invention, a portion of the water supply circuit including not only the salt container 9, but also the metering reservoir 8, is housed inside the access door 3, in the hollow space between the walls 5 and 6. In a preferred embodiment, said portion of the water supply circuit additionally includes the water softener 7.

More particularly, the water supply circuit comprises a feeding conduit 10 connected with the water mains through at least a valve 11 which is controlled by the programmer (not shown) of the machine and is preferably arranged in correspondence of a non-movable part of the casing of the machine. Downstream from the valve 11, the conduit 10 extends into the door 3 upwards (with respect to the vertical closed position of the door) to communicate with the inlet 12 of the water softener 7 through an air-break 13. Preferably, a portion 14 of the conduit 10 extending between the air-break 13 and the water softener 7 has a labyrinth-shaped configuration. The outlet 15 of the water softener 7 is connected with a conduit 16 which preferably extends towards the bottom of the dishwasher, as shown in the figure, where it is intended to communicate with the wash tub 2.

The portions of the conduits 10 and 16 which are housed inside the door 3 are connected with the portions of the conduits 10 and 16 which are housed in the non-movable part of the casing 1 through relevant break-away coupling means 17 and 18, respectively, which are arranged to break away when the door is opened as shown in the figure. More particularly, the break-away coupling means 17, 18 are located in correspondence of the bottom of the access door 3 and are for example of the simple male-female fitting type, or of the kind including a flexible water-tight seal.

In a way known per se, the air-break 13 is provided in the conduit 10 between a nozzle 19 and a diffuser 20 capable of recovering hydraulic pressure. According to another aspect of the invention, the inlet mouth of the diffuser 20 is formed at the bottom of a funnel-shaped collecting element 21 having an overflow device 22. When the door 3 is substantially closed the collecting element 21 lies above the water softener 7 and is in communication with the tub 2 through the overflow device 22 and a channel 23 provided in the access door.

Upstream of the air-break 13, the conduit 10 is provided with a branch pipe 24 having a calibrated cross-section and communicating with a first chamber 25 of the metering reservoir 8. The first chamber 25 is suitable to communicate with the tub 2 through an overflow wall 26 and an aperture 27 of the door 3. When the door is closed the overflow wall 26 determines the water volume which can be

5 collected in the chamber 25 to regenerate the water softener 7, which is lying at a lower level, as it will be described hereinafter. Such a water volume is adjustable, in a per se known manner, by means of a mass 28 whose level in the chamber 25 can be changed by acting on a knob 29. This latter is arranged outside the door 3 and is sealingly connected to the mass 28; hence, the volume of the regeneration water can be readily adjusted after having opened the access door 3.

10 The metering reservoir 8 also comprises a second chamber 30 which, when the door 3 is in a substantially horizontal open position, is laying below the first chamber 25 and is capable of communicating therewith through a siphon device 31. The latter is preferably arranged at the top of chamber 25 (with the door 3 in the closed position).

15 The bottom of the second chamber 30 communicates with the subjacent salt container 9 (with the door 3 in the closed position) through a channel 32 that is preferably provided with a thermostatic valve 33. The valve 33 is responsive to the temperature of the environment adjacent to the inner wall 6 of the access door and is arranged to open and close, respectively, when such a temperature is respectively lower and higher than a predetermined value (40° C, for instance). The thermostatic valve 33 may be for example of the bimetal type, or the like.

20 The salt container 9 has a loading aperture which is provided with a removable cap 34 and is accessible from the exterior of the door 3, preferably through the inner wall 6. Hence, even the periodical operations to refill the salt container 9 may be readily performed by opening the door of the dishwasher and removing the cap 34.

25 The outlet 35 of the salt container 9 is preferably adjacent to the inner wall 6 of the access door and is arranged to communicate with the water softener 7 through a pipe 36 having a calibrated cross-section and terminating with an outlet mouth adjacent to the collecting element 21. In particular, when the door 3 is closed the outlet mouth of pipe 36 is laying over the collecting element 21, into which brine can be delivered therefrom.

30 The operation of the dishwasher according to the invention should be apparent.

35 When the door 3 is closed the coupling means 17, 18 are joined together and the tub 2 can be fed with tap water by opening the valve 11. The tap water flows along the conduit 10, passes through the air-break 13, is softened in the water softener 7 and enters the wash tub 2 through the conduit 16. Possible water leakages in correspondence of the air-break 13 are conveyed into the tub 2 via the overflow device 22 and channel 23. Concurrently, a proportion of the tap water enters through the branch pipe 24 into the chamber 25, where it is

metered by means of the overflow wall 26; possible exceeding water falls into the wash tub through the aperture 27.

After termination of an operative cycle of the dishwasher, the valve 11 is closed and the access door 3 is completely opened (in a substantially horizontal position) to withdraw the support racks (not shown) out of the tub 2 and remove the crockery therefrom. Thus, the water contained in the chamber 25 of the metering reservoir 8 flows into the subjacent chamber 30 through the siphon device 31, which is properly sized to this aim.

It should be noted that the opening of the door 3 also promotes cooling down of the temperature sensor of the thermostatic valve 33. When the door 3 is successively closed again, the valve 33 is therefore open, or it opens within short, according to the different temperature conditions.

As a consequence, the metered amount of water contained in the chamber 30 of the reservoir 8 flows by gravity along the channel 32 and enters the salt container 9, from which the so formed brine is delivered through the calibrated pipe 36 to fall with a reduced flow into the subjacent collecting element 21. The brine slowly enters the conduit 10 through the diffuser 20 and flows to the water softener 7, from which the water formerly contained is conveyed to the bottom of the tub 2 via the conduit 16. The active mass of resins of the water softener 7 is thereby regenerated and is successively "flushed" with freshwater, in a per se known manner.

From the foregoing description the structural simplicity of the dishwasher according to the invention should be apparent, bearing in mind that the water supply circuit is substantially housed in the door 3, that is, in a position to which access may easily be gained. In addition, the portion of such a water supply circuit which is housed within the door 3 does not need any electrically-controlled device, so the wirings of the machine are substantially reduced. In particular, it is possible to substantially reduce flexible wirings extending between the door 3 and the non-movable part 1 of the machine, that are notoriously scarcely reliable and dangerous as far as electrical insulation is concerned.

By contrast, the dishwasher according to the invention is remarkably reliable. In this connection, attention is directed to the fact that an improper flow of brine from the salt container 9 towards the water softener 7 is prevented even if the door 3 is temporarily opened before termination of the operative cycle of the dishwasher. In fact, when such a temporary opening occurs during an initial phase of the operative cycle, the water volume collected in the chamber 25 is insufficient to activate the siphon device 31 and therefore cannot flow towards the

5 salt container 9. When, instead, the door 3 is temporarily opened later, that is to say, during a phase of the operative cycle in which the temperature in the tub 2 is relatively high, the thermostatic valve 33 is closed and prevents the water possibly contained in the chamber 30 from flowing towards the salt container 9.

10 At any rate, the provision of the break-away coupling means 17, 18 in the conduits 10, 16 prevents the movements of the access door from causing any possible damage of the same conduits in the long run.

15 Obviously, the dishwasher described above as an example may undergo a number of modifications without departing from the scopes of the invention.

Claims

- 20 1. Dishwasher with a water supply circuit comprising a water softener and a metering reservoir for water suitable to regenerate said water softener through a salt container, the dishwasher having a wash tub with a front access door which is hinged at the bottom on the machine and houses a portion of said water supply circuit including said salt container, **characterized in that** said portion of the water supply circuit housed in said access door (3) additionally includes said metering reservoir (8).
- 25 2. Dishwasher according to claim 1, **characterized in that** said portion of the water supply circuit housed in the access door (3) is connected with the remaining part (10, 11, 16) of the water supply circuit through break-away coupling means (17, 18) arranged to break away when said door is opened.
- 30 3. Dishwasher according to claim 1, in which said portion of the water supply circuit housed in the access door (3) also includes said water softener (7), the water supply circuit being provided, upstream of the water softener (7), with an air-break (13) defined by a nozzle (19) and a diffuser (20), **characterized in that**, with respect to the closed position of the door (3), the inlet mouth of said diffuser (20) is formed at the bottom of collecting means (21) arranged above the water softener (7) and suitable to collect brine delivered by said salt container (9) through calibrated pipe means (35, 36) terminating with an outlet mouth which is spaced apart from said collecting means (21), thereabove.
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4. Dishwasher according to claim 3, **characterized in that** the metering reservoir (8) comprises a first chamber (25) capable of collecting regeneration water, from a calibrated branch pipe (24) of the water supply circuit, to an amount as metered by overflow means (26), said reservoir (8) further comprising a second chamber (30) into which said metered amount of regeneration water is conveyed from the first chamber (25), through siphon connecting means (31), when the acces door (3) is in a substantially horizontal open position, and from which said metered amount of regeneration water is able to flow by gravity through the salt container (9) when said door (3) is in its closed position.

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5. Dishwasher according to claim 4, **characterized in that** said second chamber (30) is connected to the salt container (9) via thermostatic valve means (33) responsive to the temperature of the environment adjacent to the inner wall (6) of the door (3) and arranged to open and close, respectively, when said temperature is respectively lower and higher than a predetermined value.

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6. Dishwasher according to claim 4, in which said first chamber (25) is equipped with adjusting means for adjusting said metered amount of regeneration water, **characterized in that** said adjusting means (28) are operable from the exterior of said door (3).

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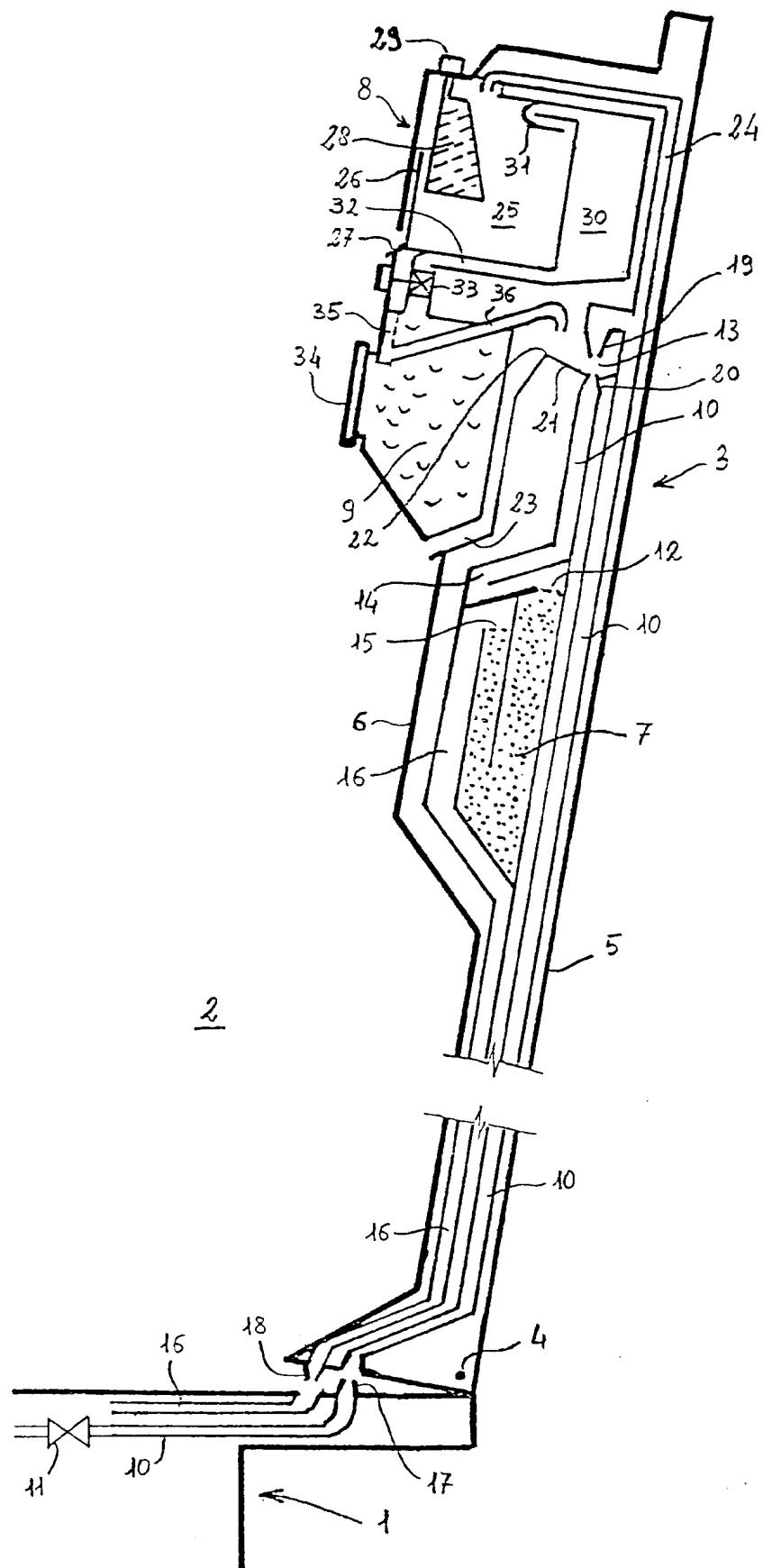
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EUROPEAN SEARCH REPORT

Application Number

EP 92 11 9523

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D, A	DE-U-8 511 185 (BOSCH-SIEMENS HAUSGERÄTE GMBH) * the whole document * ---	1	A47L15/42
D, A	DE-A-1 800 092 (P. DOSCH) * page 12, line 19 - page 13, line 15 * * figure 5 * ---	1	
A	FR-A-2 336 031 (ROBERT-BOSCH HAUSGERÄTE GMBH) ---		
A	FR-A-2 335 187 (BOSCH-SIEMENS HAUSGERÄTE GMBH) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A47L D06F
<p>The present search report has been drawn up for all claims</p>			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	28 JANUARY 1993	KELLNER M.	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			